UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/485,325	05/22/2000	JUERGEN HAHN	10191/1295	1777

26646 7590 04/22/2005

KENYON & KENYON
ONE BROADWAY
NEW YORK, NY 10004

EXAMINER	
STOCK JR, GORDON J	

ART UNIT	PAPER NUMBER
2877	

DATE MAILED: 04/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/485,325	Applicant(s) HAHN ET AL.	
	Examiner Gordon J. Stock	Art Unit 2877	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 January 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *9-14 and 16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *9-14 and 16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. **Claims 9, 10, 14, and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Finarov (5,764,365)** in evidence of **Finarov (5,333,052)** and in view of **Aspnes (3,985,447)** and further in view of **Kawahira (JP 05280937 A).**

As to **claim 9**, Finarov ('365) discloses a measurement apparatus comprising: a light source emitting a beam (Fig. 5c, **120, 130, 132**; col. 7, lines 9-67); a transmitting optical system conveying the beam to an incidence point on the substrate (Fig. 5b, **100, 150, 154**; col. 7, lines 24-58); a photodetector device (Fig. 5c, **186,170,172, 198**); a receiving optical system conveying the reflected beam to the photodetector device (Fig. 5c, **156, 152, 102**; col. 7, lines 35-37; col. 8, lines 46-64); the receiving optical system including an analyzer (Fig. 5c, **160**); an evaluation device, a data processor (col. 11, lines 19-20); an angle measurement device calculating an angle of the reflected beam at the incidence point (Fig. 5c, **152, 194, 196,** and **198**; col. 10, lines 65-67; col. 11, lines 1-6); the polarization direction of the beam and of the analyzer being modified in time relative to one another (Fig. 5b, **124** and **140**; Fig. 5c, **160** and **162**).

As for sensing versus calculating an angle, an angle is calculated from a light ray that constitutes an angle comprising the detected ray and a reference ray such as the incident ray or a reference line such as a normal to the surface of the substrate; thereby, if an angle is calculated it must be sensed in order to perform the calculation.

Finarov ('365) is silent concerning the determination of the film thickness as a function of the sensed angle and the intensity changes. However, Finarov ('365) implies the film

thickness is a function of the sensed angle and intensity changes, for ellipsometric measurements comprise measuring changes in polarization of light by reflectance and ,subsequently, from amplitude and phase changes. And Aspnes in a measurement of thin films states the dependence of amplitude and phase on angles, intensities, and reflectances (col. 4, lines 15-67; col. 5, lines 1-65). Further in evidence Finarov ('052) demonstrates relations of the variables in thickness measurements (cols. 5-7). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made that film thickness would be determined as a function of intensity changes and angles, for Finarov's ('365) system measures amplitude and phase changes to determine thickness which are proportional to an angle and intensity.

As for the tangential plane not intersecting the substrate in an area of incidence, Finarov ('365) does not explicitly state this, but implies that the angle measurement is relative to a tangential plane, a plane substantially parallel to the plane of the substrate, suggested by Fig. 5a; whereas, the tangential plane comprises the dotted line that is perpendicular to the line normal to the plane of the substrate. However, Kawahira in an ellipsometer system teaches using two tangential planes from two points outside the measuring region to determine a corrected incidence angle due to wafer unevenness (abstract; paragraphs 0014-0016 of machine translation). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have the sensed angle be relative to a tangential plane that does not intersect the substrate in the area of the incidence point in order to have the incidence angle sensed compensated for wafer unevenness.

As to **claim 10**, Finarov ('365) in evidence of Finarov ('052) and in view of Aspnes and Kawahira discloses everything as above (see **claim 9**). In addition, Finarov ('365) discloses the

angle measurement device including a photodetector unit that is position-sensitive in at least one of an X and Y direction (col. 11, lines 1-6) with an angle of reflection being calculated from position data and distance data with an evaluation stage (col. 11, lines 7-21).

As to **claim 14**, Finarov ('365) in evidence of Finarov ('052) and in view of Aspnes and Kawahira discloses everything as above (see **claim 9**). In addition, Finarov ('365) discloses a converging lens arranged in front of the photodetector device (Fig. 5c, **168**).

As to **claim 16**, Finarov ('365) in evidence of Finarov ('052) and in view of Aspnes and Kawahira discloses everything as above (see **claim 9**). In addition, Finarov ('365) discloses the transmitting optical system including a polarizer (Fig. 5b, **124**) and a quarter wave plate (Fig. 5b, **122**) in a beam path of the beam. Finarov ('365) discloses the polarizer and the analyzer being arranged in rotationally driven fashion about an axis normal to a surface of the one of the polarizer and the analyzer; whereas, Finarov ('365) discloses "the polarizer having associated therewith motor drives (Fig. 5b, **140**). Although, not shown, motor drives typically operate with precise angular encoders. (col. 8, lines 25-28)." In addition, Finarov ('365) discloses the analyzer being similar to the polarizer (col. 8, lines 55-57) with a motor (Fig. 5c, **162**).

3. **Claim 11** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Finarov (5,764,365)** in evidence of **Finarov (5,333,052)** and in view of **Aspnes (3,985,447)** and further in view of **Kawahira (JP 05280937 A)** and **Gold et al. (4,999,014)**

As to **claim 11**, Finarov ('365) discloses a measurement apparatus comprising:

a light source emitting a beam (Fig. 3; 30); a transmitting optical system conveying the beam to an incidence point on the substrate (Fig. 3, **32, 34, and 82**; col. 6, lines 20-40); a photodetector device (Fig. 3, **38**) a receiving optical system conveying the reflected beam to the

photodetector device (Fig. 3, **36, 76-79**; col. 5, lines 60-67); and the receiving optical system including an analyzer (Fig. 3, **36**). Though Finarov ('365) is silent concerning an evaluation device in Figs. 2-3, he teaches an evaluation device, a processor, in another embodiment (col. 11, lines 19-20), therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have the ellipsometer comprise an evaluation device in order to process the data gathered. Figure 5b demonstrates that the polarization direction of the beam and of the analyzer would be modified in time relative to one another (Fig. 5b, **124** and **140**; Fig. 5c, **160** and **162**).

As for an angle of reflection being calculated from position data and distance data, the systems of Figs. 2 and 3 assume the reflection angle is equal to the incident angle whereas the surface of the sample is flat. And the incidence angle is determined from the position and distances of the components of the system such as the position of the deflection mirror (col. 5, lines 20-35).

For the embodiments of Figs. 2 and 3, Finarov ('365) is silent concerning an angle measurement device. However, he teaches using an angle measurement device in an ellipsometric device that is position-sensitive in at least one of an x and y direction in order to make certain of the correct incidence angle (col. 10, lines 60-65; col. 11, lines 1-10). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have the embodiment of Fig. 3 comprise an angle measurement device that is position sensitive in at least one direction in order to make certain the incidence angle predetermined is the actual angle produced by measuring it.

As for sensing versus calculating an angle, an angle is calculated from a light ray that constitutes an angle comprising the detected ray and a reference ray such as the incident ray or a reference line such as a normal to the surface of the substrate; thereby, if it an angle is calculated it must be sensed in order to perform the calculation.

Finarov ('365) is silent concerning the determination of the film thickness as a function of the sensed angle and the intensity changes. However, Finarov ('365) implies the film thickness is a function of the sensed angle and intensity changes, for ellipsometric measurements comprise measuring changes in polarization of light by reflectance and ,subsequently, from amplitude and phase changes. And Aspnes in a measurement of thin films states the dependence of amplitude and phase on angles, intensities, and reflectances (col. 4, lines 15-67; col. 5, lines 1-65). Further in evidence Finarov ('052) demonstrates relations of the variables in thickness measurements (cols. 5-7). Therefore, it would be obvious to one skilled in the art at the time that the invention was made that film thickness would be determined as a function of intensity changes and angles, for Finarov's system measures amplitude and phase changes to determine thickness which are proportional to an angle and intensity.

As for the tangential plane not intersecting the substrate in an area of incidence, Finarov ('365) does not explicitly state this, but implies that the angle measurement is relative to a tangential plane, a plane substantially parallel to the plane of the substrate, suggested by Fig. 5a; whereas, the tangential plane comprises the dotted line that is perpendicular to the line normal to the plane of the substrate. However, Kawahira in an ellipsometer system teaches using two tangential planes from two points outside the measuring region to determine a corrected incidence angle due to wafer unevenness (abstract; paragraphs 0014-0016 of machine

translation). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have the sensed angle be relative to a tangential plane that does not intersect the substrate in the area of the incidence point in order to have the incidence angle sensed compensated for wafer unevenness.

As for the same photodetector sensing intensity changes, see previous paragraph above. In addition, Finarov ('365) implies that the photodetector 38 of Fig. 3 would sense position data, for a predetermined incident angle is set. However, Gold in an apparatus for measuring thickness of thin films does teach a detector that measures intensity changes and positional data, the positional data as a function of angle of incidence (col. 6, lines 9-40), and Gold teaches determining changes in reflectivity (Figs. 4a-c) which suggests determining intensity changes. Therefore, it would be obvious to one skilled in the art at the time the invention was made to have the apparatus comprise a photodetector sensing both intensity changes and position data to minimize the cost through the use of fewer photodetectors.

4. **Claims 12-13** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Finarov (5,764,365)** in evidence of **Finarov (5,333,052)** and in view of **Aspnes (3,985,447)** and further in view of **Kawahira (JP 05280937 A)** and further in view of **Tokuhashi et al. (5,838,432)**.

As for **claim 12**, Finarov ('365) in evidence of Finarov ('052) and in view of Aspnes and Kawahira discloses everything as above (see **claim 9**). Finarov ('365) is silent concerning the photodetector unit including two position-sensitive photodetectors whereas the angle is calculated based on differing positions of the beam on the two position-sensitive photodetectors. Tokuhashi in an angle detection apparatus teaches utilizing two one-dimensional PSD whereas the angle is calculated based on the beam positions on the photodetectors and that one

dimensional photodetectors are cheaper than two dimensional psd's (col. 14, lines 5-35). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have the apparatus comprise two one-dimensional psd's wherein the angle is calculated based on the beam positions on the photodetectors rather than one two-dimensional psd, for one dimensional psd's are much cheaper than two-dimensional psd's.

As for **claim 13**, Finarov ('365) in evidence of Finarov ('052) and in view of Aspnes, Kawahira, and Tokuhashi disclose everything as above (see **claim 12**). In addition, Finarov ('365) discloses a beamsplitter arranged in the beam path of the reflected beam in front of the psd (Fig. 5c, **194**). However, they are silent concerning the arrangement of the beamsplitter with the two one-dimensional psd's. However, it would be obvious to one of ordinary skill in the art at the time the invention was made to arrange the beamsplitter and the two photodetectors in order for the two photodetectors to receive the partial beam of the reflected beam from the beamsplitter, since it has been held that rearranging parts of an invention involves only routine skill in the art. *In re Japikse, 86 USPQ 70.*

Response to Arguments

5. Applicant's arguments with respect to the claims in Remarks filed January 13, 2005 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: "Automated Multiple Angle of Incidence Ellipsometer System," February 1, 1990, IBM Technical Disclosure Bulletin, Vo. 32, Issue No. 9A, pages 417-424 (specifically, fixed reference plane of Fig. 2).

Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a discussion with a phone interview, then the fax should:

1) Contain either a statement "DRAFT" or "PROPOSED AMENDMENT" on the fax cover sheet; and

2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as quickly as possible.

Papers related to the application may be submitted to Group 2800 by Fax transmission. Papers should be faxed to Group 2800 via the PTO Fax machine located in Crystal Plaza 4. The form of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The CP4 Fax Machine number is: **(703) 872-9306**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gordon J. Stock whose telephone number is (571) 272-2431. The examiner can normally be reached on Monday-Friday, 10:00 a.m. - 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory J. Toatley, Jr., can be reached at 571-272-2800 ext 77.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private Pair system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

gs
April 13, 2005

Layla Lauchman
Primary Examiner
Art Unit 2877